

S&S-1102

**A Process for the Manufacture of a  
Disintegrating Roll of an Open-end  
Spinning Apparatus as well as a  
Disintegrating Roll made by such  
a Process**

Description

The present invention concerns a process in accord with the concept of Claim 1, and concerns further a disintegrator roll manufactured by such a process.

In connection with a carding machine, DE 25 39 089 A1 discloses a disintegrating roll which has been equipped with a toothed active shredding-element, which displayed a substantial hardness in the top zone of the teeth, but in the foot zone a lesser hardness. In this way an ascertained winding of the toothed shredding-element on the body of the disintegrating roll could be assured. To this purpose, the point of each tooth is a separate element from the foot, and must be bound thereto, for example, by welding. This is a very labor and time intensive procedure, and for economic reasons, it cannot be allowed, that such a procedure can be a part of the manufacture of disintegrating rolls for open-end spinning apparatuses, since, for a single such carding machine, well over a hundred such rolls are required.

In accord with another proposal offered by DE 29 04 841 A1, each tooth of the sawtooth shredding-element exhibits a plurality of zones of different hardness, whereby the hardness of the tooth diminishes in the direction from the tooth point to the foot. The tooth foot zone, contrarily, is not hardened, in order to allow for the necessary shaping of the sawtooth wire necessitated by the winding procedure. In order to be able to deform the ends of this sawtooth wire, so that the wire can be securely laid on the roll body, it is necessary to temper these wire ends after the hardening procedure, so that the hardening of the teeth will have no effect on wire ends. The disadvantage of this step is, that it is

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very difficult to restrict the hardening and subsequent heat treatment to specific areas.

The purpose of the present invention is to propose a process, which enables the wear area of the teeth of a sawtooth wire to be hardened to the greatest degree, preferentially, without simultaneously hardening the foot zone of the teeth, and the purpose further includes the creation of a process, which, essentially in a simpler and more certain manner, makes possible the installation of the shredding-element, especially of a sawtooth wire. An additional purpose of the invention is to create a disintegrating roll, which can be manufactured with the aid of the aforesaid process.

This purpose is achieved by the features of Claim 1. Due to the fact, that the sawtooth wire is given its essentially final shape before it is mounted on the shredding-element carrier, the hardening, or the hardness provided for the shredding-element in connection with the installation of the shredding-element on a shredding-element carrier, is no longer of such importance, since no consideration need be given to a deformation during the laying of the shredding-element onto a shredding-element carrier.

Advantageously, the sawtooth wire, in accord with Claim 2, is shaped prior to hardening, since, in this manner, the sawtooth wire, when installed on the shredding-element, is subjected to no great stress as compared to the substantial deformation which otherwise would be a required.

In a development of the process, in accord with Claim 3, provision can be made, that the sawtooth wire, during the hardening, is to be found on a preshaping body, whereby this preshaping body, in accord with Claim 4, can be constructed by the shredding-element carrier itself.

More to the purpose, in accord with Claim 5, the ends of the sawtooth wire can be subjected to an grinding procedure.

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Principally, the hardening of the shredding-element can be carried out in various ways. However, it has shown itself as being advantageous, to harden the shredding-element by inductive heating in accord with Claim 5, and especially Claims 7 and 8, independently of the shredding-element being sawtooth wire or a combination of needles and at least one saw tooth wire. In this way, the depth, to which the hardening of the shredding-element is to be allowed, is controllable.

The shredding-element exhibits a relatively small cross section. On this account is advantageous, if, in accord with a development of the invented process, which is set forth in Claim 9, the formation of oxides, for instance mill scale, is prevented during the hardening process.

Advantageously, the hardened shredding-element, in accord with Claim 10, is subjected to a heat treatment for the avoidance of tensile stresses.

For the elimination of surface unevenness, such as the said mill scale, it is of advantage of the shredding-element is blasted, in accord with Claim 11 or 12, for instance, this can be carried out by glass bead blasting.

Since the material of the shredding-element becomes magnetic, while it is undergoing blasting, the shredding-element is advantageously demagnetized in accord with Claim 13. Furthermore, in accord with Claim 14, the shredding-element can be deburred.

In spite of the hardening of the shredding-element, it is frequently desirable to further change the surface of the shredding-element which comes into contact with the to-be-disintegrated single fibers and thereby, be suited to the material to be worked. In an advantageous development of the invented process, a coating of the shredding-element can be provided in accord with Claim 15 and possibly Claim 16.

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In order to prevent, that the finally worked-up shredding-element is out of round, the process can be improved in accord with the invention in accord with Claim 17, and particularly advantageously improved in accord with Claim 18 and/or 19. In particular, by a grinding treatment counter to the direction of the teeth of the saw tooth wire, the goal is advantageously gained wherein scale, which in the operation of the disintegrator roll can lead to non-uniform dissection of fibers, is definitely removed.

The sawtooth wire, before it is brought into its shape, is a non-hardened wire. Thereby the assurance is given, that it permits itself to be brought into the desired shape. Particularly advantageous is the use of a shredding-element carrier of non-hardening material, preferably a low carbon steel, because in this way, the imparting of tension to the shredding-element carrier by the hardening of the shredding-element can be avoided.

In a further advantageous embodiment of the invention, provision is made, that the ends of the sawtooth wire, that is, both the wire start and the wire end piece, can be welded to the shredding-element carrier.

Thereby, in a simple and secure way, it can be prevented, that the sawtooth wire will loosen itself from the shredding-element carrier either during hardening or in operation. As to method of welding, essentially all known methods can be considered. In an advantageous development of the invention, the sawtooth wire is coated, in order to better its abrasion resistance. This coating is done preferably by plasma deposition, for instance, advantageously, with titanium nitride. Thereby, it is especially favorable to operate with as low temperatures as possible, so that no hardening loss occurs in the hardened shredding-element wire by the heating of the wire.

With the aid of the previously described process, in accord with the invention, a disintegrating roll can be made as set forth in Claims 26 to 33.

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The said roll possesses a hardened shredding-element after it is shaped, that is, after the emplacement of the shredding-element on the shredding-element carrier. Further, in accord with Claim 28 this shredding-element is, advantageously, an induction hardened shredding-element. By means of the use of a shredding-element wire and employing a lateral groove at the foot zone of the installed shredding-element carrier, the sawtooth wire can be especially securely fastened on the shredding-element carrier, wherein the sawtooth wire is laid in the said groove and by means of the shaping of the material of the shredding-element carrier, the sawtooth wire is pressed into the groove to make a form-fit connection.

The above described process, in accord with the invention, makes possible in a simple and secure manner, an exactly controlled hardening of the shredding-element. Absent is any danger, when the shredding-element is fitted onto the shredding-element carrier, that the shredding-element will be damaged by this operation. Particularly when the shredding-element points have been hardened by induction, it is possible by means of high frequency current to limit the hardening to the said points of the shredding-element, while the foot part, held by the shredding-element carrier, remains in its original condition. High frequency hardening, nevertheless, is further advantageous, in that it so hardens those areas of the teeth, which form a hardness transition in each tooth, that even in the area of the tooth-foot, a hardness is attained, which strongly reduces the attrition in this area of the shredding-element. The shredding-element, or better, its teeth, also have an advantageous uniform rate of wear respectively from the tooth point to the tooth foot.

In this way the disintegrating rolls can be made with an expectancy of long life, a wear resistant shredding-element, and moreover, operate without risks of breakage or damage to the roll.

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Embodiment examples of the invention are explained in the following with the aid of drawings. There is shown in:

- Fig. 1 a sawtooth wire which can be manufactured by the invented process in perspective view
- Fig. 2 an invented disintegrator roll in profile view, and
- Fig. 3 a portion sawtooth shredding-element wrapped on a disintegrator roll as well as a grinding wheel section in profile view.

Where open end spinning is concerned, it is necessary to reduce a fiber band to individual fibers, which are then fed to an open-end spinning element (not shown) for the production of a continuous thread. The separation of the fibers by combing from the forward progressing end of the fiber band, is carried out with the aid of a disintegrator roll 1 enclosed in a housing 4. To execute its designed purpose, the disintegrator roll 4 possesses a specifically designed shredding-element 2 (Fig. 2). To serve as a shredding-element 2, a sawtooth wire 20 is employed (Fig. 1 to 3). On the other hand, there are shredding-elements which, besides one saw tooth wire 20, exhibit still a second such sawtooth wire 20 (not shown) and/or additionally a plurality of needles.

Because of the combing out of the forward progressing end of the fiber band, the shredding-element 2 is subjected to a high degree of stress. For this reason, a hardening procedure has been provided for the shredding-element 2. Such a hardening does indeed make the shredding-element 2 hard, but leads to the disadvantage that the shredding-element 2 is made brittle and can be damaged upon the deformation accompanying the fitting of the shredding-element 2 onto a shredding-element carrier 10. Such damage especially occurs in the foot zone 200 (Fig. 3) where fissures can occur.

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The shredding-element 10 of the disintegrator roll 1 can be formed by the base body 100 of the disintegrator roll 1; however, it is also possible, to provide a ring (not shown), which, in a known manner, is held in place by clamps or the like.

In order to avoid the mentioned disadvantages and ticks, in accord with the process presented in the following, the flexible, unhardened, sawtooth wire shredding-element which does not yet exhibit any great hardness (sawtooth wire 20), is first brought into the essentially desired shape which subsequently, in its installed condition, it will assume on the shredding-element holder 10. In this way the desired shape is not brought to the to-be-achieved diameter  $d$ , but the spiral shape is additionally considered, which shape the sawtooth wire 20 will assume on the shredding-element carrier on the disintegrator roll.

Principally, the shaping of the sawtooth wire 20 can be done in different ways. Advantageously however, the sawtooth wire 20 is wound on a shaping body 3 (Fig. 1), the diameter  $d$  of which is essentially just as large as the effective diameter  $D$  of the shredding-element carrier 10 for the disintegrator roll 1. In this way, it is not required to shape the sawtooth wire in any important degree during its later installation on the shredding-element carrier 10.

The final diameter  $d$ , which the sawtooth wire 20 should obtain by the shaping, is not necessarily identical with the outside diameter of the shredding-element carrier 10. As a rule, the sawtooth wire 20 is not wound onto the outside circumference of the shredding-element carrier 10, but rather is received in spiral grooving in this outside circumference of the shredding-element carrier 10 with the result, that the diameter  $d$  represents the diameter of this grooving. This is plainly to be seen in Fig. 2, in which this effective diameter  $d$  of the shredding-element carrier 10 is obviously less than the outside diameter 10 thereof.

After the sawtooth wire 20 has taken on its desired shape, it is subjected to a hardening procedure. Principally, it is not of great importance, which special hardening procedure is applied (for instance, flame-hardening.) Nevertheless, experience shows that it is particularly advantageous, if the hardening of the shredding-element 20 is done by induction. In this process, the depth of the hardening can be exactly determined by a corresponding choice of the frequency of the alternating current.

Since priority is given to having a good hardening on such surfaces as come into contact with the fibers, high frequency currents are particularly well suited for this purpose.

For that reason, the frequency of the alternating current is chosen as high as possible, so that the hardening effect is limited especially to the points 201 of the teeth, in other words, the hardening is limited to the surface of the teeth of the shredding-element. This comes about at a frequency of the alternating current of at least 1000 kHz, and especially is the case within a frequency range of 1500 and 2000 kHz. The foot area 200 of the sawtooth wire 20 remains unhardened, that is, that area where the teeth are fastened, which is seen in the direction of the shredding-element carrier 10.

The hardening of the sawtooth wire 20 can be carried out after the removal of the same from the preshaping body 3, since principally, the preshaped sawtooth wire 20 is conducted through the induced high frequency field of a coil (not shown). In this procedure, the sawtooth wire 20, in the surface area, particularly in the area of the teeth, is highly heated and after leaving the said field, is chilled.

The process, within the framework of the present invention, can be altered in various ways, especially through the substitution of individual features by equivalents or through other combinations of the features and/or equivalents. Thus, it is not required, that the hardening of the sawtooth wire 20 take place in an unsupported condition.



Much more, the sawtooth wire 20, during this hardening procedure, can still remain on the said preshaping carrier 3. This has the advantage, that the inductive hardening process can be limited, in an especially simple and secure manner to the area of the tooth points 201 to the tooth footings 203, whereby the foot area 200 of the sawtooth wire 20 retains, essentially, its original degree of hardness.

To avoid the manipulation of the sawtooth wire 20 in an already hardened condition, provision can be made in a development of the described process, wherein the sawtooth wire 20 is laid onto the shredding-element carrier just before the carrying out of the hardening procedure and is secured thereon. Then, the so secured sawtooth wire 20 is subjected to a hardening procedure, especially the described induction hardening.

According to an advantageous development of the previously described process, provision can further be made, that the hardening of the shredding-element 2 is carried out under the protection of an inert gas. In this way, it is prevented, that the surface of the sawtooth wire 20, which has been raised to a high temperature during the hardening process, reacts with oxygen and rust or scale forms, which can lead to undefined conditions and dimensioning of the teeth of the sawtooth wire 20.

Independent of what kind of hardening has been employed, there is created, in accord with the above described process, a disintegrating roll 1 having a sawtooth wire 20 which forms the shredding-element 2. This sawtooth wire, which is only hardened, preferably inductively, after it has assumed essentially its final shape, and especially after it has been secured to the shredding-element carrier 10.

As part of the hardening procedure, there follows in the customary manner, a chilling of the sawtooth wire 20 by water, oil or the like. Thereby is created internally in the sawtooth wire 20 inner stresses, which can lead to fissuring. In order to avoid these, as soon as possible after the chilling, a heat treatment (tempering) is provided, by means

of which such stresses are relieved. In accord with a preferred improvement of the described process, the hardened sawtooth wire 20, during this tempering is brought principally to a temperature of about  $130^{\circ}$ , since, in this way it is assured, that that the steel, from which the sawtooth wire 20 is made, indeed loses the internal stresses, but not the hardness.

The sawtooth wire 20 which is on the shredding-element carrier 10 is, as a rule, subjected to a grinding procedure since it known from experience, that the sawtooth wire 20 installed on the shredding-element carrier 10 is generally cut of round.

In accord with the embodiment depicted in Fig. 3, the disintegrator roll 1, now equipped with the sawtooth wire 20 is driven in the direction of the arrow  $f_1$ , that is, in the direction of the rotation (arrow  $f_2$ ), in which the disintegrator roll 1 turns during the spinning operation. The sawtooth wire 20, which is driven by the disintegrator roll 1 during the grinding operation then moves contrary to the rotation of a grinding disk 5, which is driven in the direction indicated by the arrow  $f_3$ .

Not only the points 201 of the teeth, but also the ends of the sawtooth wire 20 affixed to the disintegrator roll 1 are subjected to the grinding procedure.

This operation seeks to prevent that, , the ends of the sawtooth wire 20 fastened on the shredding-element 10, could lead in a known manner to later problems with fiber transport within the housing 4.

The hardened shredding-element 2 can still undergo a blasting operation in order to smooth its surface. This can be done in customary procedures by means of blasting with sand, small glass globules or the like.

Since the shredding-element 2 is magnetized by the blasting procedure, the shredding-element 2, advantageously, after this blasting procedure, is demagnetized. This is done, as a rule, by the production of a corresponding magnetic counter field,

whereby the shredding-element runs through the hysteresis loop with cyclic reduction of the maximal field strength.

In order to remove and round off protruding spikes and edges of the sawtooth wire 20, it is of advantage, if the sawtooth wire 20 is deburred. This can be carried out in known chemical procedures in a solution known as appropriate for this purpose, or also electrolytically with the aid of an acid solution.

If desirable, for acquiring certain surface characteristics, the shredding-element can also be coated, for instance with a galvanically applied nickel plating. In doing this, it is also possible to embed diamond kernels in the nickel layer.

It is also possible, to provide on a shredding-element carrier 10, a shredding element which possesses a sawtooth wire 20 as well as needles (not shown) in combination. Further, instead of a single sawtooth wire 20, also two such sawtooth wires 20 can be laid next to one another, whether the shredding-element 2 has auxiliary needles or not. Independent of the special design of a shredding-element 2 of a disintegrator roll 1, the here described process can be always applied with advantage.

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